The Implementation of PACS Accessible Quality Assurance Tools to Facilitate Communication Between Radiologists and Technologists

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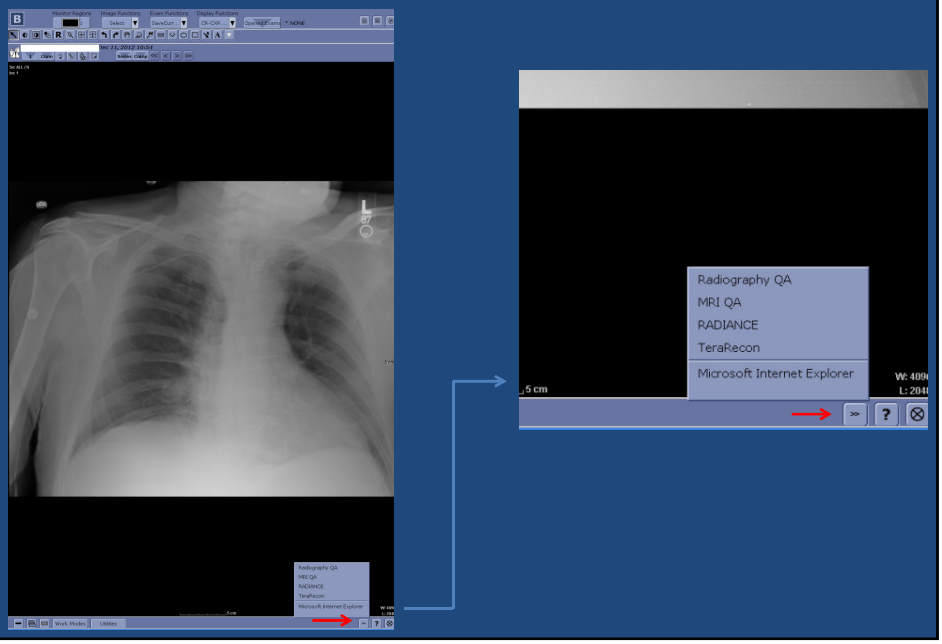
Purpose of PACS QA Tools

- Prior to implementation, there was no universal method for classifying and quantifying errors, which occur during radiologic image acquisition.
- Reporting errors required time-consuming emails or phone calls, interrupting workflow.

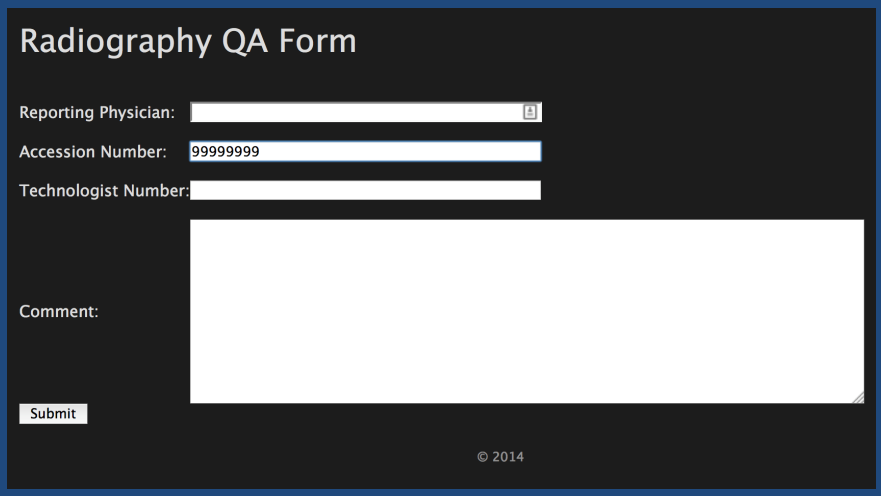
Purpose of PACS QA Tools

- Due to time constraints, many small errors went unreported.
- This system maintains a permanent record of all submissions and the intervention performed by the supervisors in response to each submission.

How It Works: The radiologist selects the icon



The radiologist fills out a brief form



Methods

- The PACS QA tools were instituted within the MSK Division at the Hospital of the University of Pennsylvania in August 2012 and department-wide in January 2013.
- After implementing the tool, two radiologists reviewed the MRI feedback obtained over an 8 month period to identify trends.

Methods

- This data was discussed with the section chiefs for body MRI, neuroradiology and MSK, and within each section one intervention was designed based on the data.
- The interventions selected were:
  - MSK: Use of appropriate-sized (Beekley) markers for imaging small body parts
  - Body MRI: Poor fat saturation
  - Neuroradiology: Reversed axial scanning (whereby axial images scroll in the opposite direction of expected thereby complicating comparison to old studies)

Methods

- The 3 interventions were discussed at the technologists' monthly meeting in December 2013.
- Radiologists within each section were encouraged to report all instances of these issues.
- Subsequently, the PACS feedback data was reanalyzed post-intervention to determine effect.

Methods

- As an additional post-intervention measure to assess technologist compliance with MSK Beekley marker usage, one radiologist reviewed:
  - 25 consecutive MRIs of small body parts obtained between October 2012 to January 2013
  - 25 consecutive MRIs of small body parts obtained between December 2013 to February 2014

Results

- There were 875 submissions to the PACS MRI QA tool between August 2012 and March 2014.
- The data were categorized as shown on the following slide.
- Submissions by department were: 480 by MSK, 289 by neuroradiology, and 106 by body MRI.

Feedback Categorization

Positive Feedback

Protocol and Image Acquisition issues
Wrong protocol
Missing sequence
Sequence parameters off (fat sat pre and post a common issue in all sections)

Positioning/ROI
Area of interest not well covered
Sequence at wrong obliquity or position
FOV too large
Marker not used appropriately

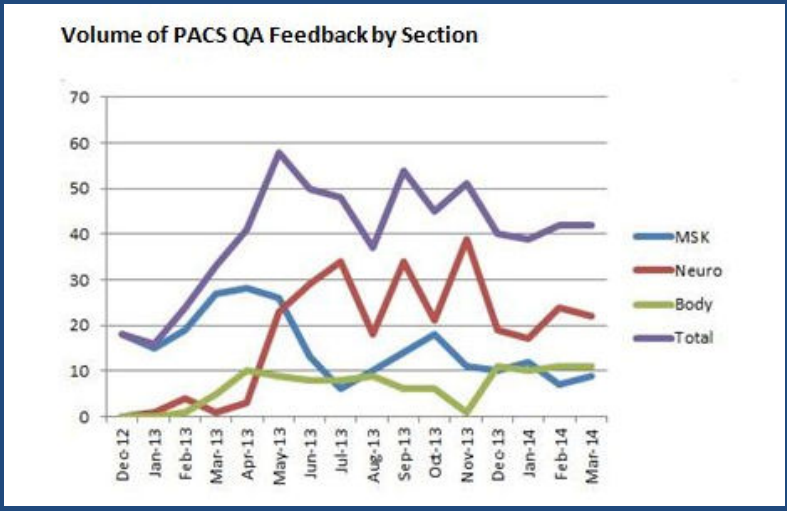
Submission to PACS Issues
Images flipped in PACS
Confusing organization of sequences
Mislabeled sequence
Laterality issues
Backwards scanning
Data inaccurary (patient name, etc)

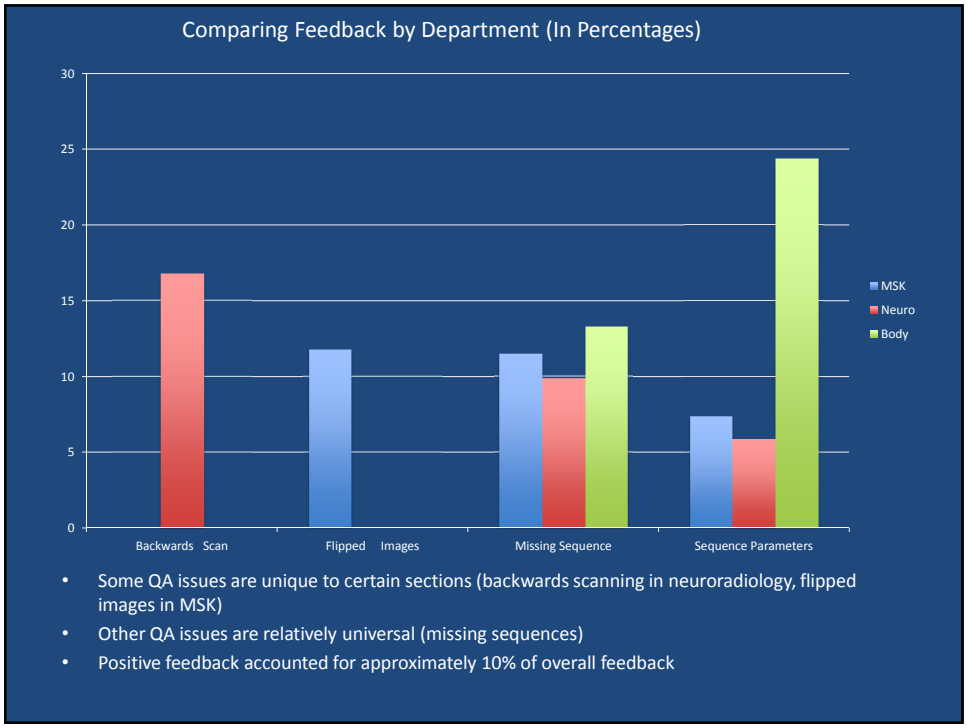
Image Quality
Poor quality NOS
Motion
Metal artifact
SNR
Poor fat sat
Coil issue
Aliasing

Contrast related

Miscellaneous

Total MRI Feedback By Month





- Some QA issues are unique to certain sections (backwards scanning in neuroradiology, flipped images in MSK)
- Other QA issues are relatively universal (missing sequences)
- Positive feedback accounted for approximately 10% of overall feedback

Interventions by Section

1. MSK: Beekley Marker Usage
2. Body MRI: Poor Fat Saturation
3. Neuro: Reverse Axial Scanning

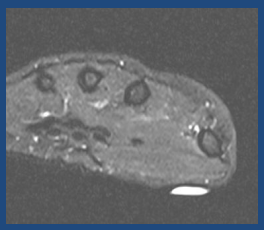
1. MSK: Beekley Marker Usage

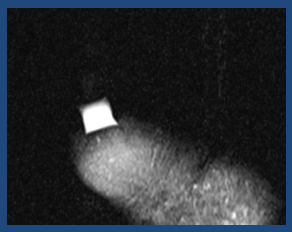
http://www.beekley.com/MRI/MRSPOTS.asp

- Smaller and thinner than Vitamin E markers
- Produce less distortion of the underlying anatomy
- Clearly visible on both T1 and T2 sequences (unlike Vitamin E markers which are difficult to visualize on T2).

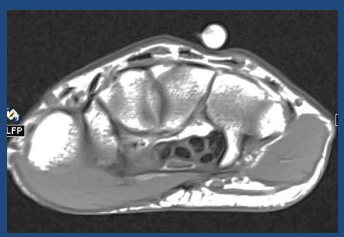
1. MSK: Beekley Marker Usage

Correct Marker





Incorrect Marker



1. MSK: Beekley Marker Usage

- Use of Beekley markers was started in late summer of 2012
- MSK staff began using the new QA tool specifically to inform the MRI supervisor regarding the use of incorrect skin markers in September of 2013
- The Technologists were reminded at their monthly meeting in December 2013 to use MR spot Beekley markers for MRIs of small body parts.

1. MSK: Beekley Marker Usage

Results

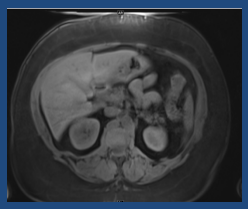
- In the review of studies performed before intervention, incorrect skin markers were observed in 8/25 MR studies.
- In the review of studies performed after intervention, incorrect skin markers were observed in 1/25 MR studies.

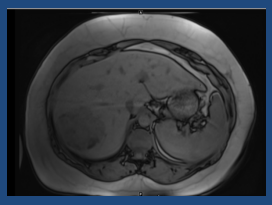
2. Body MRI: Poor Fat Saturation

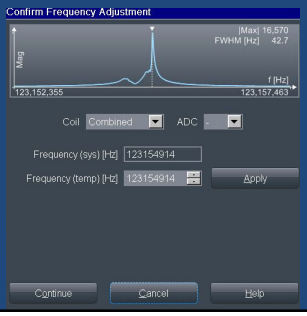
Slide (modified) from PowerPoint presented at MRI technologist monthly meeting in December 2013

Checking FS prior to Injection on Abdomen MRI

- There have been several cases this past month where the gad runs on abdomens have not been fat saturated.
- Body MR asked that we please pay closer attention in the future.
- This occurs more often with obese patients on the 3T's.
- On all T1 VIBE Pre's you will now have to confirm frequency settings to help eliminate this problem.







2. Body MRI: Poor Fat Saturation

- The PACS QA tool helped to identify the issue of poor fat saturation.
- The data was used to design an intervention.
- Anecdotally, the intervention has resulted in lower frequency of poor fat saturation.
- The improvement is not reflected in the PACS QA data, which is easily explained by underreporting prior to intervention and accurate reporting after the intervention.

3. Neuro: Reverse axial scanning

- Axial brain MRIs, which scroll in the opposite direction from prior exam complicated review of tumor and multiple sclerosis follow up cases.
- The PACS QA tool helped to identify the issue.
- This led to a meeting with the PACS vendor.

3. Neuro: Reverse axial scanning

- Reverse axial scanning was found to be work station dependent (i.e. on one work station images show up inverted and on another in proper sequence).
- This likely relates to user/workstation settings.
- The PACS vendor and PACS administrator are working on a solution.
- Other PACS providers provide a tool, which allows manual inversion of scrolling sequence, which would be one potential solution.

Limitations

- While volume of submissions has been high thus far, it is uncertain whether this will remain true over time.
  - Continuing to analyze the data and prove to the radiologists that their feedback is resulting in improved quality is likely the best method to maintain compliance.

Limitations

- The PACS QA tool is best for identifying trends and designing interventions.
  - Using the PACS QA tool in isolation to measure post-intervention outcomes is limited by the tendency of increased reporting once an issue is brought to light.

Limitations

- The PACS QA tool has not been used in a punitive manner.
  - Since the QA tool provides a permanent record of all errors, and the identities of those involved, the data could theoretically be applied in a punitive manner. This can be addressed on an institutional level.

Conclusion

- A PACS accessible QA tool is an efficient method for radiologist communication with technologists.
- While not meant to replace other forms of communication, it facilitates the communication of small errors and potential areas of improvement, which might otherwise go unreported.

Conclusion

- By analyzing the feedback data, one can identify trends, design interventions, and measure effect, with the overall goal of improving imaging quality within the department.

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